Office Equipment Manufacturer Increases Production With Automated Plating Hoist

A Wisconsin-based manufacturer of office furniture has increased productivity by 15 percent using a programmable logic controller (PLC) that runs the entire plating processing system. Krueger International, based in Green Bay, is a manufacturer of office seating, tables, conference tables, auditorium seating, file cabinets and divider walls. The company is the seventh largest manufacturer in its class, with worldwide annual sales of $260 million. Krueger employs more than 1500 people in six plants located in Wisconsin, Canada and Mississippi.

Krueger International's original plating hoist system was put into production in 1972, and was upgraded in 1988 with a proprietary automated hoist control system built by an outside consultant. For Jim Panzer, Krueger's controls engineer and system integrator, the old system presented obstacles for production improvement and future expansion plans. "The system consisted of four large control panels with a large, custom-made printed circuit (PC) board," Panzer said. "There were no part numbers, schematics or documents whatsoever. Everything was in the consultant's head."

Although the system was reliable, Panzer's biggest concern was what to do if the system should fail and the consultant was not available. "Because we plate about 50 percent of our own products, system downtime is a real concern to us," he said. "It's only a matter of several hours before the trickle-down effect is felt throughout the company."

When Krueger began to look at new control system options that it could service and modify, it found that most systems were not designed with open architecture in mind. "We wanted a fully integrated system that we could program and expand at will to meet our changing needs," Panzer said.

From a separate booth, a system operator oversees the daily work flow using a touch screen interface. A second control screen will allow employees on the plant floor to select the processing steps for each rack they load.

System Choices

There are basically two types of systems available in the plating hoist business:

- A fixed "timeway" where, if a programmable logic controller (PLC) is used, a conventional control program is created to define the required sequence of operations that the system needs to perform. According to Panzer, if the operator ever needs to change the production steps for a particular product, it can be done, but is a major undertaking that results in system downtime.
- The preferred method is "dynamic scheduling." Most dynamic systems, however, are written in a higher level programming language and require the operator to use a personal computer to modify the production schedule.

Integrated Solution

After much research, Krueger selected a proprietary PLC* with a touch control screen. The system uses 10 variable-frequency inverters and is interfaced using analog and digital input/output. The software also enables the system operator to define the desired production sequence using the touch screen interface, including the acceleration and deceleration rates, the minimum and maximum speeds, and any other parameter.

Panzer said that the old system, which utilized magnetic starters to turn the motors on and off, generated a great deal of mechanical shock. Plus, the workload and movement speed created so much inertia that it often was difficult to stop the hoist in proper station location. Because of the abrupt starting and stopping of the old hoist, the work bars would start to sway and remain in motion. If the product happened to sway at the wrong time, it could create a major

Giddings & Lewis PiC900™ PLC

crash that, depending on the amount of damage, could result in environmental and health concerns, along with significant downtime. The new system has essentially reduced this concern, Panzer said. "If you watch our hoists today, you'll notice how smoothly they arrive at each station. They just stop and click into position, and raise and lower the workload precisely."

Smooth transition

No company likes downtime, especially a "just-in-time" manufacturer such as Krueger. By working around the clock and coordinating the work of various contractors, Krueger was able to complete the installation and system start-up within 10 days in May 1994. Total cost of the project was $33,000, including all labor, electrical, removal and installation.

Once all data were assembled, software* was loaded on the system that made it relatively easy to create the "dynamic scheduling" format, according to Panzer. The user-friendly software saved much time on what would have been a time-consuming code-writing session, he said.

With advanced training in mind, Panzer and colleagues undertook another construction project. They created an actual miniature mechanical working model of the hoist system hooked up to the PLC. This enabled operators to "test drive" the system, and prepared them for production once the system was put on-line. Panzer said it only took one to two hours of training to prepare operators for production.

Fast Payback

Panzer says the system's flexibility helps solve production problems, which also contributes to quality control, and eliminates time from production runs. "We can track the entire system and, with pinpoint accuracy, identify each step of the process and any potential problems through the touch screen," he said.

Inverters installed on each hoist enable operators to control the motion profile and result in shorter cycle times, by eliminating rack sway. Krueger's original cycle time was about six min, but has been reduced by more than 30 sec since the system was installed. The company is planning to install larger braking resistors and cut the cycle time to about five min.

Giddings & Lewis PiCPro™ software

Jim Panzer, Krueger's control engineer, checks the central control panel housing the PLC and other equipment. The panel is located next to the operator control book for easy access.

The company is realizing a 15-percent productivity improvement, according to Panzer. Because downtime has also been eliminated, he says the company has already saved about $150,000 per year, which would have been spent for serving and related needs. The company expects a total system payback in less than two years.

With the new system monitoring the actual lifting and traversing parameters around the clock, operators are no longer required to physically watch the system to ensure that hoists are where they should be. They can now spend more time on other areas, such as chemistry.

Additional Enhancements

The system still requires the operator to look ahead at what is being loaded on the racks and, depending on processing needs, select the appropriate parameters from the screen menu. The PLC takes it from there. To further increase productivity, Krueger is setting up a second touch screen interface on the plant floor, to enable the person loading the racks to instruct the PLC on how to process that particular rack with preset production parameters.

Added Safety Features

Another automation feature that Panzer's group has taken advantage of is the addition of improved safety features. They recently developed a new "load checking" feature, which alerts the operator to the rack-crashing that occurred with the old system.

"On occasion, while the hoist is lowering, a loose part to be plated will catch on the side of the tank," Panzer said. "When this occurs, the workbar, racks and parts all stop while the hoist continues to descend. Inevitably, gravity causes a crash. If the operator does not stop the system in time, the hoist will traverse over the displaced components."

To prevent this, a "load checking" function block has been created on the system software that compares command velocity, accelerate and decelerate rates, actual velocity (output to inverter) and projected

A Krueger employee unloads and inspects finished products before delivery to the assembly division.

motor-load currents with actual motor-load. If the system detects an abnormal change in the motor current at a given point, it will automatically stop itself and an alarm will be activated. Additional warnings are displayed on the screens.

Krueger is pleased with the success of the new system. "The software enabled us to design color-coded maintenance, diagnostic and alarm screens. That's an example of the flexibility we were looking for in the first place," Panzer said.

Krueger's System

In addition to the PLC, Krueger's complete electroplating system includes:

- Two parallel lines, each employing two hoists and connecting to a line shuttle that transfers 17 workbar and plating rack combinations to and from each line, completing a full plating cycle.
- The company's original 24 chemical tanks, which are steam-heated.
- The plating process utilizes six power sources (rectifiers) providing 0–16 V (DC) at 0–10,000 A.

The plating system includes 42 stations (a point where the hoist stops to perform a certain operation), the 24 processing tanks, and 10 AC variable speed motors, controlled by 10 electromotive AC inverters that regulate the speed of the lift and traverse motions for each hoist. Eight of the motors are for lift and traverse motions; the other two operate the shuttle activity. o